CLAIMS

1. A photodiode comprising:

a first p-type semiconductor layer;

an n-type semiconductor layer;

a second p-type semiconductor layer disposed between the first p-type semiconductor layer and the n-type semiconductor layer such that the second p-type semiconductor is directly adjacent to the n-type semiconductor, the second p-type semiconductor layer having a graded doping concentration.

2. The photodiode of claim 1 further comprising an anode layer for collecting holes.

3. The photodiode of claim 1 further comprising a cathode layer for collecting electrons.

4. The photodiode of claim 1 wherein the first p-type semiconductor layer is InAlAs.

5. The photodiode of claim 1 wherein the n-type semiconductor layer is InAlAs.

6. The photodiode of claim 1 wherein the second p-type semiconductor layer is InGaAs.

7. The photodiode of claim 1 wherein the graded doping concentration defines a first concentration adjacent to the first p-type semiconductor layer and a second concentration adjacent to the n-type semiconductor layer, and further wherein the first concentration is greater than the second concentration.

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8. The photodiode of claim 7 wherein the first concentration is located at a position x_o and defines a concentration p_o, and further wherein the graded doping concentration is governed by the following equation:

$$p = p_o e^{\frac{-x}{D}}$$

over the depth D of the second p-type semiconductor layer for all x and D greater than zero.

9. The photodiode of claim 8 wherein the depth D is between 800 and 1000 angstroms in length.

10. A method of fabricating a photodiode comprising the steps of:

providing a substrate layer;

depositing a first p-type semiconductor layer on the substrate;

depositing an n-type semiconductor layer on the substrate;

grading a second p-type semiconductor layer from a first concentration to a second concentration, wherein the first concentration is greater than the second concentration; and

depositing the second p-type semiconductor layer between the first p-type semiconductor layer and the n-type semiconductor layer such that the second concentration is directly adjacent to the n-type semiconductor layer.

11. The method of claim 10 further comprising the step of affixing an anode to collect holes.

12. The method of claim 10 further comprising the step of affixing a cathode to collect electrons.

13. The method of claim 10 wherein the first p-type semiconductor layer is InAlAs.

8. The photodiode of claim 7 wherein the first concentration is located at a position x_o and defines a concentration p_o, and further wherein the graded doping concentration is governed by the following equation:

$$p = p_o e^{\frac{-x}{D}}$$

over the depth D of the second p-type semiconductor layer for all x and D greater than zero.

9. The photodiode of claim 8 wherein the first concentration is between 800 and 1000 angstroms in length.

10. A method of fabricating a photodiode comprising the steps of:

providing a substrate layer;

depositing a first p-type semiconductor layer on the substrate;

depositing an n-type semiconductor layer on the substrate;

grading a second p-type semiconductor layer from a first concentration to a second concentration, wherein the first concentration is greater than the second concentration; and

depositing the second p-type semiconductor layer between the first p-type semiconductor layer and the n-type semiconductor layer such that the second concentration is directly adjacent to the n-type semiconductor layer.

11. The method of claim 10 further comprising the step of affixing an anode to collect holes.

12. The method of claim 10 further comprising the step of affixing a cathode to collect electrons.

13. The method of claim 10 wherein the first p-type semiconductor layer is InAlAs.

14. The method of claim 10 wherein the n-type semiconductor layer is InAlAs.

15. The method of claim 10 wherein the second p-type semiconductor layer is InGaAs.

16. The method of claim 10 wherein the first concentration is located at a position x_o and defines a concentration p_o, and further wherein the graded doping concentration is governed by the following equation:

$$p = p_o e^{\frac{-x}{D}}$$

over the depth D of the second p-type semiconductor layer for all x and D greater than zero.

17. A photodiode having a first p-type semiconductor layer and an n-type semiconductor layer comprising:

a second p-type semiconductor layer disposed between the first p-type semiconductor layer and the n-type semiconductor layer such that the second p-type semiconductor is directly adjacent to the n-type semiconductor, the second p-type semiconductor layer having a graded doping concentration, wherein the graded doping concentration is governed by the following equation:

$$p = p_o e^{\frac{-x}{D}}$$

over the depth D of the second p-type semiconductor layer for all x and D greater than zero.

18. The photodiode of claim 17 wherein the second p-type semiconductor layer is a type III-V semiconductor.

19. The photodiode of claim 17 wherein the second p-type semiconductor layer is InGaAs.